Mark schemes

## Q1.

(a) 1. Phosphorylation of glucose using ATP;

2. Oxidation of triose phosphate to pyruvate;

*Accept removal of hydrogen from triose phosphate for oxidation.*

3. Net gain of ATP;

*Accept any description that indicates a net gain e.g., 4 produced, 2 used.*

4. NAD reduced;

*Accept NADH/$NADH_2$/NADH + $H^+$ produced.*

*Accept all mark points in diagrams.*

**4 max**

(b) 1. Less/no reduced NAD/coenzymes

**OR**

Fewer/no hydrogens/electrons removed (and passed to electron transfer chain);

*Accept less/no FAD reduced.*

2. Oxygen is the final/terminal (electron) acceptor;

**2**

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## Q2.

(c) 1. Regenerates/produces NAD
**OR**
oxidises reduced NAD;

*Reject NADP and any reference to FAD.*

*Accept descriptions of oxidation e.g. loss of hydrogen.*

2. (So) glycolysis continues;

*Accept description of glycolysis e.g. glucose to pyruvate.*

*Accept 'for oxidising/converting triose phosphate to pyruvate'.*

**2**

**[9]**

## Q3.

(a) (So the) oxygen is used/absorbed/respired;

**1**

(b) 1. Anaerobic respiration produces carbon dioxide;

2. Increase in pressure/volume (of gas);

*Reference to either volume or pressure required for the mark*

**2**

(c) 1. Correct answer in range of
$4.9 \times 10^{-4}$ to $4.91 \times 10^{-4}$ = **2 marks**;;

*Accept any equivalent mathematical representation of this answer*

2. Incorrect answer buts shows division by 24 = **1 mark**
**OR**
Incorrect answer but shows a number from 1175 to 1178 (ignore position of decimal point, standard form and any numbers that follow) = **1 mark**;
**OR**
Incorrect answer but show the number 49 (ignore position of decimal point, standard form and any numbers after 49) = **1 mark**;

**2**

(d) Large range/difference/increase in numbers;

*Accept reference to exponential (increase)*

*Ignore if the answer only refers to numbers being high*

*Ignore to 'fit on the scale'*

**1**

(e) Decrease/no glucose/substrate
**OR**
Increase in ethanol/carbon dioxide/acidity;

*Accept decrease/no oxygen as **Figure 2** is not linked to **Figure 1**.*

*Accept competition for glucose/oxygen.*

*Accept any named sugar*

*Accept decrease in pH*

*Accept increase in toxins*

*Ignore food/nutrients*

**1**

(f) 1. Correct answer of 298000 or 297766 or 297765.59 or 296826 = **2 marks**;;

*Accept: any equivalent answer with appropriate rounding*

*e.g.* $2.98 \times 10^5$,

$29.78 \times 10^4$ *etc.*

2. Incorrect answer but working shows $2000 \times 2.72$ = **1 mark**;
**OR**
Incorrect answer but working shows $2.72^{0.5 \times 10}$ / $2.72^5$ / $e^{0.5 \times 10}$ / = **1 mark**

**2**

**[9]**

## Q4.

(b) 1. Less / no malonyl-CoA;
2. (More) fatty acids transported / moved into mitochondria;
3. Respiration / oxidation of fatty acids provides ATP;

*1. 'Inhibition of malonyl-CoA' on its own is not enough but accept production of malonyl-CoA is inhibited.*

*2. Accept: 'transport of fatty acids into mitochondria is not inhibited'.*

*2. Ignore: method of entry.*

*3. Accept: for respiration any stage of aerobic respiration e.g. Krebs (cycle), link (reaction) etc.*

*3. Reject: production of energy, **but** accept production of energy in the form of ATP.*

*3. Accept: acetyl CoA can enter Krebs cycle / mitochondria to provide ATP.*

**3**

**[7]**

## Q5.

(a) 1. Equilibrium reached.

*Accept equilibrate*

2. Allow for expansion / pressure change in apparatus;
3. Allow respiration rate of seeds to stabilise.

*Ignore seeds acclimatise*

**3**

(b) 1. Optimum temperature / temperature for normal growth of seeds;
2. (Optimum temperature) for enzymes involved in respiration.

**2**

(c) 1. Oxygen taken up / used by seeds;
2. $CO_2$ given out is absorbed by KOH (solution);
3. Volume / pressure (in **B**) decreases.

**3**

(d) 0.975 / 0.98.

*If incorrect,*

*0.26 × 6 / or incorrect numbers divided by 1.6 for 1 mark*

**2**

**[10]**

## Q6.

(a) 1. Increases dissociation of oxygen;

*Accept unloading/ release/reduced affinity for dissociation*

2. For aerobic respiration at the tissues/muscles/cells

**OR**

Anaerobic respiration delayed at the tissues/muscles/cells

**OR**

Less lactate at the tissues/muscles/cells;

**2**

(b) 1. (Time) 10 minutes;

2. (Ratio) 1.6875(:1);

Allow 1 mark for correct ratio calculated from wrong time

*For the ratio accept any correct rounding*

**2**

(c) 1. Increase in breathing (rate);

*Award mark points 1 and 2* ***OR*** *3 and 4*

*Allow more breaths per minute*

*Reject more BPM*

2. Similar/same $pCO_2$ per breath, but more breaths;

**OR**

3. Increase in tidal volume;

*Accept each breath is deeper*

4. Similar/same $pCO_2$ per breath, but increased volume per breath;

**2**

(d) Second box ticked (Muscle fibres have a limited amount of phosphocreatine.)

**1**

(e) 1. More acetylcoenzyme A would enter the Krebs cycle;

2. (So) the Krebs cycle generates (more) reduced coenzymes

**OR**

(So more) reduced coenzymes pass their electrons to the electron transfer chain;

*Accept examples of reduced coenzymes*

*Reject production of reduced NADP or* $NADPH_2$

3. (So more) ATP would be produced;
   *idea for more is required once*

4. Athletes could build (slow) muscle (fibres) without exercising;
   *Ignore 'develop (slow) muscle (fibres) at rest' as in stem of question*
   *Accept description of not exercising, eg without training*

5. (Having more) slow muscle (fibres) would increase endurance;
   *Accept descriptions of endurance in terms of delayed onset of anaerobic respiration*

**4 max**

(f) 1. (EPO) causes blood to thicken;
   *Accept descriptions of thickening, eg more viscous*

2. (The thickened blood) could block the coronary arteries

   **OR**

   (The thickened blood) slows blood flow

   **OR**

   (The thicker blood) could cause clots;
   *Reject atheroma/plaque (forms)*
   *Accept could cause thrombus/embolus*

**2**

(g) 1. Some cyclists will gain a bigger advantage/increase

   **OR**

   Cyclists with a haematocrit of 50% would not be able to gain an advantage;
   *Accept use of the data, or suitable calculations, eg some may have an 8% increase, others 0%*
   *Some cyclists might naturally have a haematocrit over 50% (and so not be allowed to compete)*

2. There are health risks (associated with) taking EPO;
   *Accept dangerous side-effects of taking EPO, or examples of health risks*

**2**

**[15]**

## Q7.

(a) 1. Line graph with rate on y axis and temperature on x axis and linear scales;

2. Values calculated to appropriate sf;

3. Rates correctly calculated and plotted, with ruled line connecting points and no extrapolation;

**3**

(b) 8 or 9;

**1**

(c) 1. Determine the area under the curve;

**1**

(d) 1. Enzymes / metabolism faster;

2. Higher rate of respiration and carbon dioxide production / release;

3. Spiracles open more often / remain open to excrete / get rid of carbon dioxide / get more oxygen;

*Note – explanation required*

**3**

**[8]**